AMENDMENTS TO THE CLAIMS

The listing of claims below replaces all prior versions of claims in the application.

1. (Currently Amended) A motor controller for simultaneously controlling operations of at least two system motors by pulse-width modulation, comprising:

a pair of switches for supplying driving power to a pair of system motors among said at least two system motors, respectively;

a pair of pulse signal generators for generating a pair of pulse signals respectively having predetermined duty ratios at predetermined cycles, and outputting said pulse signals to said pair of switches to turn on or off said pair of switches; and

inversion means for inverting~~, with respect to~~ a phase of an input signal to one of said pair of pulse signal generators, such that a phase of one of said ~~two~~ pair of pulse signals that is generated and output by one of said ~~two~~ pair of pulse signal generators~~, a phase of the other of said two pulse signals, which is generated and output~~ is phase shifted by 180 degrees with respect to a phase of a pulse signal generated and output by the other of said ~~two~~ pair of pulse signal generators~~, by 180 degrees~~.

2. (Original) The motor controller as set forth in claim 1, wherein said one pulse signal is caused to rise at a leading edge of said predetermined cycle, and by inverting the phase of said other pulse signal by 180 degrees by said inversion means, said other pulse signal is caused to fall at said leading edge.

3. (Original) The motor controller as set forth in claim 1, further comprising:

a counter for counting a clock signal, outputting the count to said pair of pulse signal generators, and resetting said count at said predetermined cycles;

wherein said pair of pulse signal generators compare said count from said counter with duty set values that are set at said predetermined cycles to determine said predetermined duty ratios, and generate and output said two pulse signals according to the result of comparison, respectively;

and wherein said inversion means is constructed as a phase shifter that inverts a phase of said count that is output from said counter to said other pulse signal generator, with respect to a phase of said count that is output from said counter to said one pulse signal generator.

4. (Original) The motor controller as set forth in claim 1, further comprising restriction means that, when there is overlap of said two pulse signals in which said pair of switches are simultaneously turned on by said one pulse signal and said other pulse signal that is inverted by said inversion means, selects one of said two pulse signals and adjusts a waveform of the selected pulse signal to restrict operation of the switch that is turned on by said selected pulse signal.

5. (Original) The motor controller as set forth in claim 4, wherein said restriction means comprises:

priority-order determination means for determining the priority order of said two system motors, based on the content of a predetermined operation request made on said two system motors and characteristics of a device to be driven by said two system motors;

restriction-ratio setting means for setting, based on the content of said predetermined operation request and the characteristics of said device, a restriction ratio of said overlap so that operations of said two system motors, which are performed according to said predetermined operation request, end simultaneously; and

adjustment means for selecting as said selected pulse signal a pulse signal that is output to the motor with lower priority determined by said priority-order determination means, and adjusting a waveform of said selected pulse signal according to said restriction ratio set by said restriction-ratio setting means.

6. (Currently Amended) A conveyance robot for conveying a cartridge with a storage medium in a library apparatus that has a shelf for storing said cartridge and a deck for accessing said storage medium, comprising:

a hand mechanism for inserting and removing said cartridge while grasping said cartridge;

a moving mechanism, which includes two system motors, for two-dimensionally moving said cartridge grasped by said hand mechanism; and

a control unit for simultaneously controlling operations of said two system motors by pulse-width modulation;

wherein said control unit comprises:

a pair of switches for supplying driving power to said two system motors, respectively,

a pair of pulse signal generators for generating a pair of pulse signals respectively having predetermined duty ratios at predetermined cycles, and outputting said pulse signals to said pair of switches to turn on or off said pair of switches, and

inversion means for inverting~~, with respect to~~ a phase of an input signal to one of said pair of pulse signal generators, such that a phase of one of said ~~two~~ pair of pulse signals that is generated and output by one of said ~~two~~ pair of pulse signal generators~~, a phase of the other of said two pulse signals, which is generated and output~~ is phase shifted by 180 degrees with respect to a phase of a pulse signal generated and output by the other of said ~~two~~ pair of pulse signal generators~~, by 180 degrees~~.

7. (Original) The conveyance robot as set forth in claim 6, wherein said control unit causes said one pulse signal to rise at a leading edge of said predetermined cycle, and by inverting the phase of said other pulse signal by 180 degrees by said inversion means of said control unit, said other pulse signal is caused to fall at said leading edge.

8. (Original) The conveyance robot as set forth in claim 6, wherein:

said control unit further comprises a counter for counting a clock signal, outputting the count to said pair of pulse signal generators, and resetting said count at said predetermined cycles;

said pair of pulse signal generators compare said count from said counter with duty set values that are set at said predetermined cycles to determine said predetermined duty ratios, and generate and output said two pulse signals according to the result of comparison, respectively; and

said inversion means is constructed as a phase shifter that inverts a phase of said count that is output from said counter to said other pulse signal generator, with respect to a phase of said count that is output from said counter to said one pulse signal generator.

9. (Original) The conveyance robot as set forth in claim 6, wherein said control unit further comprises:

restriction means that, when there is overlap of said two pulse signals in which said pair of switches are simultaneously turned on by said one pulse signal and said other pulse signal that is inverted by said inversion means, selects one of said two pulse signals and adjusts a waveform of the selected pulse signal to restrict operation of the switch that is turned on by said selected pulse signal.

10. (Original) The conveyance robot as set forth in claim 9, wherein said restriction means comprises:

priority-order determination means for determining the priority order of said two system motors, based on the content of a predetermined operation request made on said two system motors and characteristics of said moving mechanism to be driven by said two system motors;

restriction-ratio setting means for setting, based on the content of said predetermined operation request and the characteristics of said moving mechanism, a restriction ratio of said overlap so that operations of said two system motors, which are performed according to said predetermined operation request, end simultaneously; and

adjustment means for selecting as said selected pulse signal a pulse signal that is output to the motor with lower priority determined by said priority-order determination means, and adjusting a waveform of said selected pulse signal according to said restriction ratio set by said restriction-ratio setting means.

11. (Currently Amended) A library apparatus comprising:

a shelf for storing a cartridge that houses a storage medium;

a deck for accessing said storage medium; and

a conveyance robot for conveying said cartridge between said shelf and said deck, comprising:

a hand mechanism for inserting and removing said cartridge while grasping said cartridge,

a moving mechanism, which includes two system motors, for two-dimensionally moving said cartridge grasped by said hand mechanism, and

a control unit for simultaneously controlling operations of said two system motors by pulse-width modulation;

wherein said control unit of said conveyance robot comprises:

a pair of switches for supplying driving power to said two system motors, respectively,

a pair of pulse signal generators for generating a pair of pulse signals respectively having predetermined duty ratios at predetermined cycles, and outputting said pulse signals to said pair of switches to turn on or off said pair of switches, and

inversion means for inverting~~, with respect to~~ a phase of an input signal to one of said pair of pulse signal generators, such that a phase of one of said ~~two~~ pair of pulse signals that is generated and output by one of said ~~two~~ pair of pulse signal generators~~, a phase of the other of said two pulse signals, which is generated and output~~ is phase shifted by 180 degrees with respect to a phase of a pulse signal generated and output by the other of said ~~two~~ pair of pulse signal generators~~, by 180 degrees~~.

12. (Original) The library apparatus as set forth in claim 11, wherein said control unit causes said one pulse signal to rise at a leading edge of said predetermined cycle, and by inverting the phase of said other pulse signal by 180 degrees by said inversion means of said control unit, said other pulse signal is caused to fall at said leading edge.

13. (Original) The library apparatus as set forth in claim 11, wherein:

said control unit further comprises a counter for counting a clock signal, outputting the count to said pair of pulse signal generators, and resetting said count at said predetermined cycles;

said pair of pulse signal generators compare said count from said counter with duty set values that are set at said predetermined cycles to determine said predetermined duty ratios, and generate and output said two pulse signals according to the result of comparison, respectively; and

said inversion means is constructed as a phase shifter that inverts a phase of said count that is output from said counter to said other pulse signal generator, with respect to a phase of said count that is output from said counter to said one pulse signal generator.

14. (Original) The library apparatus as set forth in claim 11, wherein said control unit further comprises:

restriction means that, when there is overlap of said two pulse signals in which said pair of switches are simultaneously turned on by said one pulse signal and said other pulse signal that is inverted by said inversion means, selects one of said two pulse signals and adjusts a waveform of the selected pulse signal to restrict operation of the switch that is turned on by said selected pulse signal.

15. (Original) The library apparatus as set forth in claim 14, wherein said restriction means comprises:

priority-order determination means for determining the priority order of said two system motors, based on the content of a predetermined operation request made on said two system motors and characteristics of said moving mechanism to be driven by said two system motors;

restriction-ratio setting means for setting, based on the content of said predetermined operation request and the characteristics of said moving mechanism, a restriction ratio of said overlap so that operations of said two system motors, which are performed according to said predetermined operation request, end simultaneously; and

adjustment means for selecting as said selected pulse signal a pulse signal that is output to the motor with lower priority determined by said priority-order determination means, and adjusting a waveform of said selected pulse signal according to said restriction ratio set by said restriction-ratio setting means.

16. (Currently Amended) A computer-readable storage medium with a motor control program for causing a computer to realize

a motor control function of simultaneously controlling operations of at least two system motors by pulse-width modulation, said motor control program causing said computer to function as:

a pair of pulse signal generators for generating a pair of pulse signals, which turn on or off a pair of switches for supplying driving power to a pair of system motors among said at least two system motors, respectively, having predetermined duty ratios at predetermined cycles, and outputting said pulse signals to said pair of switches; and

inversion means for inverting~~, with respect to~~ a phase of an input signal to one of said pair of pulse signal generators, such that a phase of one of said ~~two~~ pair of pulse signals that is generated and output by one of said ~~two~~ pair of pulse signal generators~~, a phase of the other of~~

~~said two pulse signals, which is generated and output~~ is phase shifted by 180 degrees with respect to a phase of a pulse signal generated and output by the other of said ~~two~~ pair of pulse signal generators~~, by 180 degrees~~.

17. (Original) The computer-readable storage medium as set forth in claim 16, wherein:

said motor control program causes said computer to function as a counter for counting a clock signal, outputting the count to said pair of pulse signal generators, and resetting said count at said predetermined cycles;

said motor control program causes said pair of pulse signal generators to compare said count from said counter with duty set values that are set at said predetermined cycles to determine said predetermined duty ratios, and generate and output said two pulse signals according to the result of comparison, respectively; and

said motor control program causes said inversion means to function as a phase shifter that inverts a phase of said count that is output from said counter to said other pulse signal generator, with respect to a phase of said count that is output from said counter to said one pulse signal generator.

18. (Original) The computer-readable storage medium as set forth in claim 16, wherein said motor control program causes said computer to function as restriction means that, when there is overlap of said two pulse signals in which said pair of switches are simultaneously turned on by said one pulse signal and said other pulse signal that is inverted by said inversion means,

selects one of said two pulse signals and adjusts a waveform of the selected pulse signal to restrict operation of the switch that is turned on by said selected pulse signal.

19. (Original) The computer-readable storage medium as set forth in claim 18, wherein, when said motor control program causes said computer to function as said restriction means, said computer is caused to function as:

priority-order determination means for determining the priority order of said two system motors, based on the content of a predetermined operation request made on said two system motors and characteristics of a device to be driven by said two system motors;

restriction-ratio setting means for setting, based on the content of said predetermined operation request and the characteristics of said device, a restriction ratio of said overlap so that operations of said two system motors, which are performed according to said predetermined operation request, end simultaneously; and

adjustment means for selecting as said selected pulse signal a pulse signal that is output to the motor with lower priority determined by said priority-order determination means, and adjusting a waveform of said selected pulse signal according to said restriction ratio set by said restriction-ratio setting means.